003851 4

START

STATE OF WASHINGTON

DEPARTMENT OF ECOLOGY

Mail Stop PV-11 • Olympia, Washington 98504-8711 • (206) 459-6000

September 23, 1994

Mr. Ron Izatt, Assistant Manager
Environmental Management, Acting
U.S. Department of Energy
P.O. Box 550, A3-42
Richland, WA 99352

9413292.0349

OCT 1994
RECEIVED

Dear Mr. Izatt:

Re: Action Memorandum; N Springs Expedited Response Action Cleanup Plan
U.S. Department of Energy Hanford Site, Richland, WA

This Action Memorandum constitutes the approved cleanup alternative to be implemented at N Springs. The approval is based upon the information contained in the Administrative Record and public comments received.

A number of public comments were received by the Washington State Department of Ecology (Ecology) on the N Springs Expedited Response Action Proposal, DOE/RL-93-23, Revision 0 (proposal). The preferred alternative selected in the proposal was the continued evaluation of all three cleanup alternatives considered. This conclusion prompted public comment in three major areas: risk analysis, adequacy of the existing database, and a majority interest in proceeding with the pump and treat cleanup alternative.

Although a formal risk analysis has not been performed at N Springs, the existing database, which includes sample results from 1985 through 1991, indicates an average strontium-90 flux concentration of 6,000 pCi/L to the river, which is in excess of 750 times the current drinking water standard. The most recent analysis of samples collected in 1993 shows an increased strontium-90 concentration of 11,000 pCi/L. The three parties, the United States Department of Energy (USDOE), the United States Environmental Protection Agency (EPA), and Ecology recognized the need for action at N Springs and agreed on January 8, 1993, to conduct a non-time critical Expedited Response Action (ERA).

The existing database includes information on well installation and monitoring of over 50 wells and 13 seeps. This information indicates the need for corrective action and, together with the historical records produced during the installation of and initial operations of N Reactor, provides a significant database. The implementation of the approved alternative will include the need for specific modelling of the groundwater flowpath, geologic conditions at the site of installation, and the conditions which exist at the point of effluent discharge.

Ecology and EPA agree with the majority of public comments that support the selection of a pump and treat system. However, the installation of a pump and treat system may not sufficiently reduce the flux of strontium-90 to the river. The uncertainties associated with groundwater flowpaths which exist at the N Springs require the use of a combination of alternatives. This includes a pump and treat system and a removable vertical barrier. The combination of these two alternatives achieves the goals of the ERA.

I. PURPOSE

The purpose of this ERA is to reduce the strontium-90 contamination flux to the groundwater that feeds N Springs, evaluate commercially available treatment options for strontium-90, and provide data necessary to set demonstrable strontium-90 groundwater clean-up standards.

II. BACKGROUND

Pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the EPA recommended the 100 Area of the USDOE operated Hanford Site for inclusion on the National Priorities List (NPL) on June 24, 1988. In November 1989, the 100 Area was added to the NPL. The N Springs are located within the geographic area of the 100-NR-1 and 100-NR-2 Operable Units (OU) as described by the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement). All data, reports, and remediation activities conducted at N Springs under this ERA will be coordinated with the RCRA past practice site remedial activities conducted at these two OUs.

The three parties agreed to conduct an ERA at N Springs in 1993. This agreement was defined in the Senior Executive Committee settlement of the TPA Milestone M-14-00 dispute signed January 8, 1993. The intent of this agreement was to implement an abatement action by November 1994.

A. Site Description

The N Springs are a series of groundwater seeps located along the southern bank of the Columbia River adjacent to the N Reactor. Historical flow from the N Springs to the river was substantially altered in 1963 with the operation of the N Reactor. Cooling water, drawn from the Columbia River, passed through the reactor and during upset conditions, was discharged into one of two liquid waste disposal facilities known as the 1301N and 1325N cribs.

The 1301N crib and trench received radioactive contaminated water from 1963 through 1985, at an average flow of 2,100 gal/min. The crib is 290 ft long, 125 ft wide, and approximately 12 ft deep. The walls of the crib are sloped and covered with soil and gravel with a 3 ft layer of boulders in the bottom. The zig-zag shaped extension trench is 1,600 ft long by 50 ft wide and 12 ft deep. Precast concrete panels were placed over the crib and trench to minimize wildlife access and airborne contamination. The 1301 crib and trench are located approximately 1,000 ft inland from the Columbia River.

The 1325N crib was constructed as a replacement of the 1301N crib and first received contaminated water in 1983. It is 250 ft long, 240 ft wide and 15 ft deep. A 3,000 ft long extension trench was constructed to provide additional operating capacity. The trench is 55 ft wide and 7 ft deep, and is covered by precast concrete panels to limit access. The 1325N crib and trench are located 2,400 ft from the Columbia River, directly behind the 1301N crib.

Between 1983 and 1985, both cribs received waste water from the reactor. In 1985, all wastewater discharge was directed to the 1325N crib at an average flow of 1600 gal/min. This flow continued until 1987, at which time the reactor was placed in a standby condition. Discharge substantially decreased until all flow ceased in 1991. The total volume of water discharged to the cribs was 23.4 billion gallons with a radionuclide inventory of 2,451 Ci of strontium-90. This influx of contaminated water resulted in excess groundwater flow to the N Springs, which contained strontium-90 contamination.

The volume of water discharging from the springs has decreased in recent years because the water table in the 100 N Area has dropped approximately 20 ft since 1989. Spring discharge is also dependent on the stage of the Columbia River. When the river stage increases, water flows from the river into the aquifer. The effects from this inflow are occasionally monitored as far inland as the 1301N crib. As the river stage decreases, the reverse occurs with groundwater discharging from the springs to the river.

B. **Site Characterization**

Characterization of N Springs consists of the monitoring of wells and seeps in the N Area. A detailed account of the monitoring conducted and other historical data available can be found in the administrative record located at WHC/BCSR, 2440 Stevens Center Place, Richland, WA 99352.

Springs/Seeps

Water samples are collected annually from wells placed in adjacent springs and seeps which discharge to the river. Average results of these analyses for the period from 1985 to 1991 indicate an average concentration of 6,000 pCi/L of strontium-90 in the N Springs. The most recent data gathered in 1993 indicates a concentration of strontium-90 of 11,000 pCi/L. The current Federal Drinking Water Standard for strontium-90 is 8 pCi/L (re: 40 CFR 141).

Monitoring Wells

Monitoring of the groundwater in the 100 N Area is conducted through the quarterly sampling of approximately 50 wells located throughout the area. The monitoring program (RCRA Detection Monitoring) has not detected hazardous chemical constituents above regulatory levels. However, radionuclides, primarily tritium and strontium-90, are present. Comparison of groundwater concentrations from 1990 and 1993 indicate a decline in the concentration of strontium-90 beneath the 1325N crib, but strontium-90 concentrations below the 1301N crib have remained steady. Wells N-3 and N-14, located between 1301N crib and the Columbia River, show an increase in strontium-90.

Tritium, although not the target constituent of this ERA, is present in significant concentrations in the 100 N Area groundwater. Tritium levels have also declined in the groundwater beneath the 1325N crib and have remained steady in the vicinity of the 1301N crib. However, tritium concentrations in two wells, N-14 and N-41, have increased to 80,900 pCi/L and 33,400 pCi/L respectively. The Federal Drinking Water Standard for tritium is 20,000 pCi/L (re: 40 CFR 141).

Other groundwater contaminants which may impact the success of the approved alternative are the presence of a sulfate plume and a diesel fuel plume. The sulfate plume is currently estimated to be on the western edge of the 100 N Area near the 1324-NA percolation pond. The diesel fuel plume is located on the top of the water table beneath the 100 N Area. This contamination is the result of historical spills and leaks occurring near the N Reactor building. These contaminants, although not directly involved in this ERA, may present interferences in the control of the strontium-90.

Cultural Resource Review

The 100 N Area is situated near an archaeologically rich segment of the Columbia River shoreline. Within the area perimeter are five recorded sites. All of the sites are either listed in or considered eligible for inclusion in the National Register of Historic Places. In addition, two other sites have been recorded.

The double fenced compound of the 100 N Area has been investigated and cleared of cultural resources concerns. No known sites of Native American religious or ceremonial significance, or sites included in the National Register of Historical Places, exist within the compound itself. No sites have been recorded along the stretch of riverbank adjacent to the N Springs. In preparation for this ERA, a cultural resources review was conducted for the N Springs area. The Hanford Cultural Resources Laboratory (HCRL) found no cultural resources in the proposed project area and gave the site a clearance number (Hanford Cultural Resources Clearance [HCRC] #92-100-032).

Flora and Fauna Survey

Biological surveys were conducted in the area of the ERA in 1991 and 1992. No critical or sensitive habitat were identified by those surveys. To ensure that impacts to potentially endangered or threatened environmental species and wildlife are minimized, a flora and fauna survey will be conducted prior to implementation of the approved alternative.

Wetlands Review

A wetlands review was conducted in 1994 in preparation for this ERA and no significant wetlands conditions were identified during this survey. Practical methods will be employed during the implementation of the approved alternative to minimize impacts on the existing conditions at N Springs.

III. THREAT TO PUBLIC HEALTH OR WELFARE AND THE ENVIRONMENT

Although a formal risk analysis has not been performed at N Springs, the existing database, which includes sample results from 1985 through 1991, indicates an average strontium-90 flux concentration of 6,000 pCi/L to the river, which is in excess of 750 times the current drinking water standard. The most recent analysis of samples collected in 1993 shows an increased strontium-90 concentration of 11,000 pCi/L.

A. Present Conditions

Sampling and analysis results gathered under the RCRA Detection Program have identified radionuclide contamination at N Springs. The primary contaminant of concern is strontium-90. Two interim actions have occurred at the N Springs to reduce the potential for radiological exposure to the public and the environment. A rip rap cover consisting of large boulders was placed over the N Springs seeps in 1984 to minimize the accessibility of the seeps to both human and fauna contact. Control of vegetation in the area of the seeps was initiated in 1990 with the removal of mulberry bushes and the application of herbicides to prevent regrowth of potential food sources. No further physical changes have occurred at N Springs.

USDOE is proposing to substantially reduce the flux of strontium-90 to the Columbia River through the implementation of the approved action at N Springs.

B. Applicable, or Relevant and Appropriate Requirements (ARARs)

9413292.0354

The ERA will be conducted in accordance with 40 CFR 300.415 and is an interim response action which will contribute to the efficient performance of anticipated long term remedial action. The ERA will, to the extent practicable, considering the exigencies of the situation, attain ARARs. At a minimum, a 90 percent reduction in strontium-90 concentrations will be achieved. However, the treated groundwater may still exceed applicable drinking water standards for tritium and strontium-90, and the discharge of treated groundwater may not comply with WAC 173-218 requirements. The discharge of strontium-90 will be conducted as described below. Other waste(s) derived in implementing the ERA will be managed in compliance with substantive ARAR requirements.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action approved herein, may present an imminent and substantial endangerment to public health or welfare, and the environment.

V. PROPOSED ACTION AND ESTIMATED COSTS

In January 1994, USDOE prepared a cleanup plan (DOE/RL-93-23, Revision 0) incorporating an engineering evaluation/cost analysis (EE/CA) of technologies that were applicable to the N Springs. The proposal was submitted to EPA and Ecology for parallel review, and was also made available for public comment for a period of 45 days. Public meetings regarding N Springs and the EE/CA were held on February 28, 1994, in Hood River, Oregon, and on March 2, 1994, in Richland, Washington, to discuss cleanup alternatives. The plan proposed four alternatives: the no-action alternative (as required by CERCLA), pump and treat options, vertical barriers, and hydraulic control. The recommendation of the EE/CA was continued study of alternatives B, C, and D as stated below. The details of these alternatives are presented in the cleanup plan.

An evaluation of the proposed alternatives follows. This evaluation is based on applicable regulations, the ERA goal, public comments received, and the administrative record for this ERA.

A. NO ACTION: No Action was included as an alternative in the N Springs Engineering Evaluation/Cost Analysis (EE/CA) as required by CERCLA, 40 CFR 300.415. This alternative provides the baseline from which to assess the effectiveness of the other alternatives being considered. This alternative would not reduce the strontium-90 flux to the groundwater which feeds the N Springs.

B. PUMP AND TREAT: The Pump and Treat alternative was discussed using two extraction options, two treatment configurations, and four effluent disposal options. The EE/CA evaluated the effectiveness of each pumping option in reducing the contaminant flux to the river. The three and five well extraction systems considered would reduce the strontium-90 contamination to the river by 67% and 96%, respectively, and also would provide hydraulic control of other groundwater contaminants. Specific modelling would be required to ensure the correct placement and pumping rates of the extraction wells. The cost estimated for this alternative within the EE/CA ranged from $5.85M to $22.43M.

C. SLURRY WALL: The Slurry Wall alternative would construct a 2800 ft long, 104 ft deep, and 5 ft wide low permeability wall made of a bentonite/soil mixture. The wall would dam the contaminated groundwater and artificially raise the groundwater table. This physical barrier would reduce the strontium-90 contamination to the river from behind the wall by 71% at the proposed 100 ft zone. Strontium-90 contamination existing in front of the wall and movement of contaminated groundwater around the wall ends was not considered. The wall would be a permanent structure, as removal costs are prohibitive and would itself become a source of contamination flux as desorption would begin to occur after ten years. The cost estimated for this alternative was $10M. This alternative would not reduce the strontium-90 flux to the groundwater which feeds the N Springs.

D. HYDRAULIC CONTROL: The Hydraulic Control alternative would place 11 wells upgradient of the contamination plume. By pumping these upgradient wells, the natural groundwater flow would be disrupted and the groundwater table lowered. Pumping rates would be monitored to ensure the contaminant plume remains stagnant and does not move toward the wells. The movement of the contaminated groundwater toward the river would be slowed and contaminants reaching the Columbia River reduced. The groundwater removed would be monitored for contamination and released to the river. It is estimated that this alternative would reduce 50% of the strontium-90 concentrations greater than 1,000 pCi/L at a cost of $2.74M. This alternative would not reduce the strontium-90 flux to the groundwater which feeds the N Springs.

Following the public comment period, two review actions occurred which have been included in the administrative record regarding this ERA. First, an independent technical review of the EE/CA was conducted by a panel of experts commissioned by USDOE. They concluded that the groundwater modelling was inadequate in that it did not reflect the heterogeneous conditions believed to exist at N Area. In addition, the use of a vertical barrier, specifically a grouted sheet pile wall, along the river's edge as a means to intersect preferential pathways was identified. This technology was evaluated by the EE/CA and considered impractical because of the presence of large boulders in the originally modelled location of 100 ft from the river's edge. However, placement of a sheet pile wall at the river's edge greatly reduces the likelihood of encountering boulders.

Secondly, a historical review of documents related to the original geologic studies conducted prior to installation of the cribs was conducted by USDOE. The documents provide conflicting results concerning the estimated flowpath and travel times associated with groundwater beneath the N Area. There were, however, field tests conducted in which sampling of effluent streams from N Reactor (Iodine 131) to the 1301 crib were then identified approximately nine days later at N Springs. This travel time indicates a heterogeneous condition (i.e., preferential pathway) exists at N Springs instead of the homogeneous system used in the modelling.

As a result of the public comments received, the conclusions reached in the independent technical review, and the information provided in the historical documents, a fifth alternative (E) was developed which combines a pump and treat system and a vertical barrier.

E. PUMP AND TREAT/VERTICAL BARRIER: This alternative would combine a pump and treat system with a removable vertical barrier. The pump and treat system would consist of extraction well(s) and an ion-exchange resin bed with the resulting treated effluent discharged upgradient within the 100N Area. The location of the extraction wells and point of effluent discharge would be determined through specific modelling. This modelling would optimize the placement of the extraction wells and would evaluate the effect and distribution of the discharge with a preference for discharge of the effluent at a point(s) which would allow for ultimate recovery of the discharge at the extraction well(s). In optimizing the placement of the extraction well(s) in relation to the effects caused by the installation of the vertical barrier, the modelling will also evaluate a range of flowrates for the pump and treat system from 50 gallons per minute to 180 gallons per minute. The cost estimated for this portion of the combined alternative is based upon the configuration and costs described in alternative (B) and ranges from $2.24 to $10.09M.

The removable vertical barrier would consist of a grouted hinge sheet pile wall with a minimum length of not less than 3000 feet, installed in close proximity to the river's edge. As described above, the specific location and total length of the wall will be determined through the modelling effort. The depth required to contact the impervious layer at the river's edge is estimated at 50 feet. The grouted hinge sheet pile wall consists of steel sheets with interlocking hinges which are driven or vibrated into the ground to the desired depth. The interlocking hinges allow successive sheets to be added to extend the wall to the length necessary and once in-place form an annular space which is then filled with a grout material. This sealable cavity enhances the impervious capability of the wall to a hydraulic conductivity of 10^{-8} to 10^{-10} cm/s. Conventional unsealed sheet piles, historically used on the Columbia River as coffer dams, offer a hydraulic conductivity of 10^{-4} to 10^{-5}. Once installed the sheets are cut off below grade to minimize any impact to the immediate topography. At the time of final cleanup of the N Springs the sheet pile wall may be removed by lifting out each sheet of steel, thus restoring the natural flow of the springs. The estimated cost of this portion of the combined alternative is $6.74M. Therefore the total cost of the combined alternative ranges from $8.98M to $16.83M.

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

Should this action not be undertaken, strontium-90 will continue to seep into the Columbia River at its present concentrated average of 6,000 pCi/L which is in excess of 750 times the current drinking water standard. With the inventory of 2451 Ci of strontium-90 known to have been discharged to the soil column, a significant delay or no action would continue the seep of radionuclide contaminated groundwater to the Columbia River and would require over 300 years to decay to the current drinking water standard of 8 pCi/L.

VII. APPROVED ALTERNATIVE

Conditions at N Springs meet the National Contingency Plan, section 300.415 (b)(2) criteria for a removal action. EPA and Ecology hereby approve the following alternative (E) for implementation to meet the goals of this ERA. The pump and treat system will initially operate at 50 gpm, will be designed so as to allow ease of (entire system) expansion, will be designed to aid evaluation of commercially available Sr-90 treatment technologies, and will be operated in order to optimize treatment system efficiency. Effluent discharge of the treated water will be upgradient within the 100 N Area for the purpose of recovery at the system influent point(s).

This pump and treat technology will be enhanced with the installation of a grouted hinge sheet pile wall with a minimum length of 3000 feet, installed at the river's edge. An initial system operations letter report, which evaluates the effectiveness of the system along with recommendations for upgrades, will be submitted to Ecology and EPA for approval in accordance with their respective authorities. Submittal of the report will be consistent with schedules within the Tri-Party Agreement N Area Pilot Project change request number M-16-94-02. Success of initial system operations and the need for expansion will be determined by Ecology and EPA, and will be based on factors including, but not limited to, the ability of the system to meet state and federal drinking water standards and the extent to which expansion can reduce the flux of Sr-90 to the river.

The pump and treat system will be designed and operated with the goal of meeting EPA's current draft Sr-90 drinking water standard of 42 pCi/L. The actual discharge concentrations will be dependent on the concentration of Sr-90 in the extracted groundwater. EPA and Ecology believe a 90% reduction in Sr-90 concentration from the extracted groundwater is appropriate as a minimum requirement. System effectiveness will be verified, and will include monthly samples collected from one monitoring well located at each end of the wall and two monitoring wells located between the wall and the river. Effluent discharge from the treatment system will be verified by the collection of influent and effluent samples at least monthly.

The pump and treat system will be designed for continuous operation (excluding agreed upon allowable startup, upset and normal maintenance downtime, as may be negotiated by the parties). An operations/health and safety plan will be in place prior to continuous operations and will describe general and specific safety concerns, operations and maintenance of equipment, and disposition of wastes generated by the process. Analyses and daily operating logs are to be submitted to EPA and Ecology monthly.

The USDOE will initiate construction of the sheet pile wall by February 1995, and will complete construction by June 1995. The pump and treat system will be constructed, installed, and operational by September 1995. This decision was developed in accordance with CERCLA, as amended by the Superfund Amendments and Reauthorization Act (SARA), and the National Contingency Plan. This decision is based on the administrative record for this project and is expected to contribute to the efficient performance of anticipated long term remedial action for the site.

Ecology is the lead regulatory agency for this project. If you have further questions, please contact Phillip Staats at (509) 736-3029.

Jeffrey P. Breckel for
Drusilla Butler, Manager
Nuclear Waste Program
Washington State Department of Ecology

Randall F. Smith
Randall F. Smith, Director
Hazardous Waste Division
U.S. Environmental Protection
Agency, Region 10

9413292.0359

cc: Bryan Foley, USDOE
Mike Thompson, USDOE
Bob Holt, USDOE
Pam Innis, EPA
Doug Sherwood, EPA
Larry Arnold, WHC
Tom Demmitt, BHI
Administrative Record (N Springs)